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NOVEL MATERIALS FOR MORE ROBUST SOLID OXIDE FUEL CELLS IN SMALL SCALE APPLICATIONS

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Solid oxide fuel cells can offer supply of electrical energy with a high efficiency and based on a wide range of fuels. While natural gas and/or bio methane is a commonly used fuel for combined heat and power supply, liquid fuels such as gasoline, Diesel and alcohols are interesting fuels, especially for remote fuel cell systems. For those applications, redox tolerant and Sulphur resistant fuel electrode materials are advantageous in order to make the cells more tolerant against sudden system failures such as fuel cut off and reformer breakdown. Also for direct feeding of alcohols and higher hydrocarbons, coking tolerant electrodes are required. State-of art fuel electrodes are based on a nickel ceramic composite, a nickel cermet, which suffers from low redox stability, susceptibility for sulfur poisoning and coking. Redox stable anodes can be achieved by replacing the Ni-cermet fuel electrode by an electronically conducting ceramic, e.g. strontium titanate with incorporated nano-scaled electro catalysts. Full cells using LSM/YSZ cathodes have been developed and tested as single 5 x 5 cm2 cells and up 100 cm2 circular cells. The initial performance exceeded 0.4 W/cm2 at 850 °C and redox tolerance has been proven in a 1 kW system environment. The cell concept provides flexibility with respect to the used electro-catalysts and various metals including Ni and Ru infiltrated in a niobium modified strontium titanate have been studied as regards their electrochemical performance and stability. Stable power output has been observed for Ru and Ru/Gd modified ceria (CGO) as infiltrate. The stability of the nano scaled electro catalysts depends on the materials combinations and the role of the possible catalyst-support interactions will be discussed.

Keywords: Solid oxide fuel cells, ceramic anodes, redox tolerance

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